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Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, DC 20554

In the Matter of	)	
	)	
An Inquiry into the Commission's Policies and Rules regarding AM Radio Service Directional Antenna Performance Verification	)	MM Docket No. 93-177

To: Mass Media Bureau

COMMENTS OF CRAWFORD BROADCASTING COMPANY

Transmitted herewith on behalf of Crawford Broadcasting Company are comments to the above-referenced rule making proceeding.

Respectfully Submitted,

CRAWFORD BROADCASTING COMPANY

By _____
John S. Neely
Its Attorney

October 21, 1993

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In the Matter of	)	
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An Inquiry into the Commission's	)	
Policies and Rules regarding AM	)	MM Docket No. 93-177
Radio Service Directional Antenna	)	
Performance Verification	)	

COMMENTS OF
CRAWFORD BROADCASTING COMPANY

Crawford Broadcasting Company
Donald B. Crawford, President
W.C. Alexander, Director of
Engineering

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An Inquiry into the Commission's Policies and Rules regarding AM Radio Service Directional Antenna Performance Verification	)	MM Docket No. 93-177

COMMENTS OF
CRAWFORD BROADCASTING COMPANY

The following comments are filed by Crawford Broadcasting Company ("Crawford") in response to the release of the Commission's Notice of Inquiry in In re: An Inquiry into the Commission's Policies and Rules regarding AM Radio Service Directional Antenna Performance Verification ("Notice"). Crawford and its affiliates are the licensees of eleven radio broadcast stations, including directional AM stations KBRT • Avalon, CA; KCBC • Riverbank, CA; KLZ • Denver, CO; KPBC • Garland, TX; KPHP • Lake Oswego, OR; and WDCW • Syracuse, NY.

I. Introduction

As the licensee of several AM directional radio stations, Crawford has a degree of experience in constructing, tuning, and making performance verification (proof of performance) measurements on such facilities.

In the course of tuning and maintaining these arrays, we have observed that conventional measurement equipment is seldom indicative of the true array parameters. For instance, base current ammeters or sampling loops will almost never give a true picture of the amount of field radiated from a given structure. Some measurements required by the Commission's rules are both burdensome and relatively meaningless, while others, if properly taken, could provide a much clearer picture of antenna operation.

Over the past several years, we have observed changes in the environment, particularly near urban areas where most all of our

directional arrays are located. These changes have been the result of development and urbanization. Antenna sites that were situated on remote pastureland miles from the nearest settlement just a few years ago are now surrounded by residences, shopping centers, power lines, and schools. Landmarks that we once used to identify monitoring point locations are now either gone or unrecognizable, and in order to keep licensed monitoring point descriptions current as required by the Commission's rules, licensees must continually file new descriptions and even change monitoring point locations as old monitoring locations become unreachable.

As we make requisite partial proof of performance field strength measurements, we find that we cannot locate the original measurement locations as used in the last full proof of performance. Many of the locations that we can identify are unusable because of local disturbances in the field caused by objects or structures that have been erected since the last full proof was made. When we assimilate the data from the measurements that we have made, many times we find a tremendous amount of scatter on the plotted fields, making numerical analysis truly nothing more than a "guesstimate" of the actual inverse distance field along the radials. This may or may not provide a useful indicator of the actual performance of a directional array.

As engineers, we need performance verification methods that allow us to remove these environmental factors – both manmade and natural – from the equation. As licensees, we need a way to control the very high cost of proving array performance.

II. Instrumentation

As stated above, seldom do toroidal current transformers installed below the base insulator or sampling loops installed above the base insulator give a true picture of either the true current ratios or the relative fields in directional antenna systems. There are many reasons for this, among them non-sinusoidal current distribution along the radiating elements and currents induced by other radiating elements.

In the past, sinusoidal current flow has been assumed (even though it was known that such was not the case), and array tune-up was done by the "cut and try" method. This method was expensive and time consuming (and not particularly spectrum-efficient because the array under adjustment was often operated at considerable variance from the design pattern shape and size during adjustment, causing interference).

In this day, we have available several remarkable tools to aid us in the design and adjustment of directional arrays. At the top of this list is the personal computer. Using advanced method of moments programs, engineers can model arrays to a great degree of accuracy, predicting closely the final operating parameters as well as the actual current distribution on the elements – even including the effects of reradiating objects and structures that are not actually a part of the array. From the results of such modeling, the in-adjustment operating parameters at the actual sampling point can be predicted, greatly simplifying the adjustment process and improving the relevance of the information provided by the sampling system.

We believe that the Commission should delete its rules that require the maintenance of base current ratios. In our experience, in those systems where loop sampling is used, there may be no absolute relationship between base current and field ratio. Changes in base

impedances caused by local environmental factors can lead to significant variations in base currents while the field ratios among the individual radiators remains constant. In those systems where base sampling is used, the base current ratios and the ratios as read on the antenna monitor are the same. Thus, the base current ratios are correct if the ratios read on the antenna monitor are correct. Lifting the requirement to maintain meaningless base current ratios would eliminate this unnecessary burden on the broadcaster.

III. Performance Verification

It is becoming more and more difficult to conduct a full directional antenna proof of performance as required by §73.151 of the Commission's rules due to urbanization of this nation. Most radio station transmitter sites are, of necessity, located near population centers. Finding accessible, unobstructed measurement locations is difficult in many cases. Another factor is that measurement locations are often difficult to pinpoint on topographic maps because of the amount of change and development that has occurred since the last revision of the U.S. Geological Survey maps used in the proof.

Further, we do not believe that it is necessary in all cases to make the great number of measurements required by §73.186 to establish the performance of a directional antenna, or to establish the circularity and effective field at 1 kilometer of the non-directional pattern.

A. Non-Directional Measurements

Broadcasters now have enough experience in the characteristics of vertical radiators of various lengths to

predict with a great degree of accuracy what the inverse distance field will be. It is difficult, time-consuming and expensive to make numerous close-in non-directional measurements to establish the non-directional inverse distance field at 1 kilometer. In our experience, when these extensive measurements are completed and the data analyzed, most always the data agrees closely with the chart contained in §73.190, Figure 8, of the Commission's rules.

We believe that the Commission should allow broadcasters to use §73.190, Figure 8 in lieu of the close-in non-directional measurements required by §73.186 in most cases. Further, we believe that the Commission should allow and accept the close-in measurements if the broadcaster desires to make and submit them for the purpose of proving a variation in the non-directional inverse distance field, but should not require such measurements except in special or critical cases.

In order to safely be able to assume that the non-directional pattern is undistorted and circular, some method of successfully de-tuning unused towers must be employed. In the past, the bases of unused towers have been terminated in a reactance that, through trial-and-error, produced minimum current flow at a certain point on the tower. This method seems to work fairly well, depending upon the electrical length of the tower and the position at which the current is sampled. Now, modern moment method modeling techniques can very accurately predict the reactance values needed to terminate the bases of unused towers in order to detune them. We believe the Commission should explore this method of unused tower detuning and allow its use as an alternative to conventional methods of unused tower detuning.

B. Directional Measurements

In recent years and mostly outside the U.S., computer moment method antenna modeling has been used along with magnetic field measurements for the purpose of demonstrating the performance of directional antenna arrays. In these cases, the computer model predicted the value of the near-array magnetic field at points on a grid. A measurement of the magnetic field was then made at each of these locations, and the results compared to the model. Where the measured fields all agreed within a specified tolerance (say, 1 dB) of the predicted field, it was assumed that the array was in adjustment and operating properly.

This method of performance verification has many advantages over conventional radial measurements. First, it removes ground conductivity from the equation. Second, all the measurements are made by personnel on foot either on the ground system or on the transmitter site property, reducing the cost of the measurements to a fraction of the cost of conventional measurements. Third, this eliminates altogether the requirement to make non-directional measurements. Finally, this method reduces the time required to make the measurements by an order of magnitude.

We believe that the Commission should explore this method of performance verification and take steps to allow its use in most cases. To be used properly and consistently, a standard model must be selected and named. Then, an acceptable deviation from model values for the field measurements must be established. A study of the aforementioned actual cases wherein this method was used should prove enlightening.

In addition to the model-method of performance verification, we believe that the Commission should continue to allow conventional proof of performance procedures to be used, with the exception that it not require up to 18 measurements per radial. Our experience has been that ten measurements per radial are adequate to establish the inverse distance field at one kilometer along each radial. As specified in §73.154(b), for the purposes of partial proof of performance measurements, ten measurements per radial between 3 and 16 kilometers is acceptable. We believe that this number of measurements is also acceptable for full proofs of performance as well. This will eliminate the distinction between full and partial proofs of performance, provided that partial proofs of performance include non-directional measurements in order to separate the effects of varying soil conductivity values.

IV. Conclusion

Crawford applauds the Commission for undertaking this Notice of Inquiry. Many of the existing rules that govern the technical administration of the AM Broadcast Service are decades out of date and do not reflect or take advantage of technology and techniques that are now available.

We encourage the Commission to modify its rules to:

- Delete the requirement to maintain base current ratios
- Delete the requirement to make non-directional close-in measurements
- Permit the use of §73.190 Figure 8 to establish non-directional inverse distance field in lieu of non-directional close-in measurements

- Continue to allow the use of close-in non-directional measurements when such are desirable or useful
- Permit the use of the model/near-array magnetic field measurement methods to prove directional antenna performance
- Continue to allow the use of conventional far-field proof of performance techniques when such are desirable or useful
- Reduce the number of conventional far-field measurements required per radial from 18 or more to ten, with those being made between 3 and 16 kilometers from the array center

By doing so, the rules will be brought into line with current technology and modern techniques that were not available when they were originally written. Further, a great burden will be lifted from the shoulders of many broadcasters. We can envision even a reduction in interference taking place as a result of such rulemaking. We believe that a great many stations that are now economically unable to bring their substandard facilities into compliance will then be able to do so. Others will be able to make facility changes that have thus far been too costly to make.

Respectfully submitted,
CRAWFORD BROADCASTING COMPANY

W.C. Alexander
Director of Engineering

October 15, 1993

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